

and extended fully 40° in a west-east direction. The color was light yellow, the movement slow, and the appearance that of an immense boa-constrictor. There was the oval head, slightly raised, the constriction forming the neck, the abdominal enlargement, the long tapering tail, and the sinuous gliding snake motion. A few moments later a flash of purple zigzag lightning moving parallel and much more swiftly passed north of the station. To the various forms (zigzag, globe, heat, etc.) of lightning we can add *snake*, i. e., *serpentine* lightning. This observation was clear and distinct.

Will not the varying resistance of the atmosphere account for the various forms of lightning observed?

OBSERVATIONS AT RIVAS, NICARAGUA.

The records contributed for many years by Dr. Earl Flint, at Rivas, Nicaragua, include barometric readings. His present station is at 11° 26' N., 85° 47' W. The observations at 7:17 a. m., local time, are simultaneous with Greenwich 1 p. m. The altitude of this barometer is now said to be 4 feet above ground; the thermometer 6 feet above ground; the rain gage 7 feet above ground. The ground is 210 feet above sea level. Until the barometer has been compared with a standard it seems hardly necessary to publish the daily readings. The wind force is recorded on the Beaufort scale, 0-12. When cloudiness is less than $\frac{1}{10}$, the letter "F," or "Few," is recorded.

This station is situated on the western shore of Lake Nicaragua, not far from the eastern end of the western division of the Nicaragua Canal. The volcano Ometepe, on an island in Lake Nicaragua, is about 10 miles northeast of the station. Dr. Flint's records occasionally mention the presence of clouds on the summit of this mountain.

Dr. Flint's reports to the Weather Bureau now embrace two distinct features, namely, the simultaneous morning observations and the daily climatological summary, as given in the two accompanying tables for each month.

Simultaneous observations at 1 p. m. Greenwich (or 7:17 a. m. local) time, September, 1899.

Date.	Temperature.		Wind.		Upper clouds.			Lower Clouds.		
	Air.	Dew-point.	Direction.	Force.	Kind.	Amount.	Direction from.	Kind.	Amount.	Direction from.
1.....	77	73	nw.	0				k.	8	se.
2.....	78	75	n.	1	cs.	10	sw.			
3.....	78	75	sw.	1	ck, s.	6		k.	few.	sw.
4.....	78	75	sw.	1				ak.	3	sw.
5.....	77.5	75	nw.	0	cs.	22	nw.	k.	6	se.
6.....	80.5	77	se.	3	cs.	22		fk.	5	se.
7.....	80	76	ne.	5				ak, k.	5	ne.
8.....	80	76	ne.	4	cs.	10	se.	k.	few.	ne.
9.....	79	72	ne.	3	c.	1	se.	k.	few.	ne.
10.....	79	74	ne.	0	cs.	1	se.	k.	9	ne.
11.....	79	75	ne.	3	cs, ck.	2				
12.....	79	72	ne.	3	c.	1	se.	fk.	few.	ne.
13.....	79.5	75	e.	3	cs.	few.	se.	k.	few.	se.
14.....	79.5	72	se.	3	cs.	few.	se.	k.	few.	se.
15.....	80.5	75	e.	2	cs.	6		k.	few.	e.
16.....	79	72	ese.	3				fk.	8	ese.
17.....	78	74	se.	2				ak.	9	se.
18.....	80	76	se.	2				k, kn.	10	se.
19.....	78	77	e.	4				ak, k.	9	se, e.
20.....	77	74	se.	6				kn.	10	se.
21.....	79	76	ne.	2	cs.	9	se.	ks, k.	few.	ne.
22.....	80	76	ne.	1	cs.	6	se.	ak, fk.	3	ne.
23.....	80	76	ne.	5	cs.	10	ne.	fk.	few.	ne.
24.....	80	76	ne.	4				fk.	8	ne.
25.....	80.5	75	ne.	2	cs.	10	se.			
26.....	80	76	ne.	0	ck.	8	se.	k.	few.	se.
27.....	81	77	ne.	1	ck.	8	se.	ak.	2	ne.
28.....	79	75	ne.	3				fk.	10	ne.
29.....	79.5	76	ne.	1	cs.	9	se.	ks, fk.	1	se.
30.....	80	74	ve.	1				fk.	5	ne.
Means....	79.2									
Departure	+2.3									

Climatological observations for twenty-four hours ending at 7:17 a. m. local (or 1 p. m. Greenwich) time, September, 1899.

Date.	Temperature.		Wind.		Average cloudiness.	Total rainfall.	Rainfall at Sapoa.
	Maximum.	Minimum.	Prevailing direction.	Maximum force.			
1.....	86.2	74	ese.	5	8	0.00	0.00
2.....	86.4	75	nw, e. sw.	3	7	0.00	0.00
3.....	88.5	74	sw, nw.	4	6	0.00	0.00
4.....	89	75	w, sw.	4	5	0.00	0.00
5.....	86	75	nw.	4	8	0.93	0.00
6.....	86	75	variable	3	7	1.93	0.01
7.....	85	75	se.	5	8	T.	0.19
8.....	86.3	79	ne.	5	5	0.00	0.04
9.....	84	78	ne, e.	6	7	0.00	0.45
10.....	88	78	ne.	6	6	0.06	1.52
11.....	88.5	78	ne.	3	8	0.05	0.00
12.....	88	78	ne.	5	6	0.00	0.00
13.....	87	77.2	ne.	5	3	0.00	0.00
14.....	88	77.2	e.	5	2	0.00	0.03
15.....	89	77	e, se.	6	5	0.00	0.28
16.....	88	79	e, se.	7	7	0.21	0.00
17.....	85	78	e, se.	7	7	T.	0.25
18.....	87	78	se.	4	4	0.00	0.31
19.....	88	80	se.	4	9	0.57	0.81
20.....	86.2	78	e, ne.	5	4	0.04	0.01
21.....	80	79	e, se.	6	10	0.51	0.02
22.....	84	78.4	ne.	4	9	0.00	0.44
23.....	81	79.2	ne.	6	9	0.08	0.00
24.....	87	79	ne.	6	5	0.00	0.02
25.....	89.2	79.4	ne.	4	3	0.00	0.00
26.....	90	80	ne.	4	6	T.	0.00
27.....	88.3	79.4	ne.	3	7	0.00	0.00
28.....	89	80	ne.	3	8	0.00	0.43
29.....	90	79	ne.	6	9	0.69	0.48
30.....	86	78.2	ne.	8	8	T.	0.06
Sums.....						5.07	5.94
Means.....							
Departure.....						-4.72	

In this report for September Mr. Flint gives the rainfall at Sapoa, Nicaragua which, like Rivas, is on the southwest shore of Lake Nicaragua, and is about 15 miles southeast of Rivas. He states that the total rainfall during August at Sapoa was 8.91 inches. The details for September are printed above.

Simultaneous observations at 1 p. m. Greenwich (or 7:17 a. m. local) time October, 1899.

Date.	Temperature.		Wind.		Upper clouds.			Lower clouds.		
	Air.	Dew-point.	Direction.	Force.	Kind.	Amount.	Direction from.	Kind.	Amount.	Direction from.
1.....	77	73	n + w	0	ck.	8	nw.			
2.....	77.5	74	n + w	0	ck.	10	nw.	k.	few.	se.
3.....	78	75	n + w	0				ak, fk.	9	nw, se.
4.....	78	75	sw.	0	ck.	2		k.	7	sw.
5.....	78.5	75	ne.	0				fk, ks.	9	ne.
6.....	78	75	n.	0	ck.	5	se.	s, fk.	1	se.
7.....	77.5	74	n + w	1				k.	1	e.
8.....	79	75	ne.	2				ak, *	2	ne.
9.....	78	73	n.	0	cs.	10	se.	k.	4	ne.
10.....	78	75	nw.	1				*		
11.....	77	74	n + w	0				ak, k.	10	e.
12.....	78	75	n.	0				k.	9	se.
13.....	78	75	n.	0				n.	10	ne.
14.....	76.5	75	n + e	0				ks, k.	1, 9	se.
15.....	75	74	w.	0				k, s.	10	e.
16.....	76	75	sw.	0				kn, ks.	9	sw.
17.....	76	75	nw.	0				ak, k.	1, 9	se, nw.
18.....	76	73	n.	0	ck.	3	se.	s.	6	se.
19.....	79	75	nw.	1	ck, cs.	8	se.	k.	2	ne.
20.....	77.5	75	ne.	0				fk.	10	ne.
21.....	75	73	nw.	0	cs, ck.	10	w.			
22.....	75	74	n + w	0				ak.	10	w.
23.....	75	73	n.	0				ks.	10	w.
24.....	74.5	73	sw.	0				ak, k.	10	sw.
25.....	76	73	sw.	0				kn.	10	sw.
26.....	75	74	sw.	2				ak, u.	1, 9	sw.
27.....	75	75	sw.	3				n.	10	sw.
28.....	75.5	75	sw.	0				n.	10	sw.
29.....	76	73	sw.	0				ks, fk.	10	sw.
30.....	77	75	sw.	0				ak.	7	sw.
31.....	77	75	ne.	1				kn.	10	ne.
Means....	76.4									
Departure	-0.5									

* Cumuli on Ometepe.

Climatological observations for twenty-four hours ending at 7:17 a. m. local (or 1 p. m. Greenwich) time, October, 1899.

Date.	Temperature.		Wind. Prevailing direction.	Maximum force.	Average cloud-ness.	Total rainfall.	Rainfall at Sapoa.
	Maximum.	Minimum.					
1	87	79	ne, e.	3	6	Inches. Ins.	
2	87	76.5	n, e.	4	4	0.00	0.00
3	89	75	n, ne.	3	5	0.00	0.00
4	84	73.7	n, w.	4	5	0.84	0.00
5	86	73	sw.	3	6	0.00	0.00
6	87.2	75	ne.	7	7	0.05	0.03
7	87.4	75.5	nne.	3	8	0.20	0.00
8	86.5	76	nne.	3	5	0.35	0.43
9	86.4	76	ne.	4	6	0.07	0.10
10	86.3	75	ne.	3	6	0.00	0.05
11	87.5	74.5	ne.	3	8	0.10	0.10
12	84.5	76	wnw.	3	7	0.36	0.01
13	87	75	nw by n.	2	8	1.99	0.28
14	86	75	nww.	3	8	0.65	1.67
15	85	76	n to se.	2	8	0.07	0.02
16	82	75	w, nw.	3	9	0.50	0.10
17	82.3	75	sw.	3	8	0.22	0.02
18	85	75	w, nw.	4	6	0.01	0.00
19	86	74	ne.	4	7	0.09	0.17
20	82	78	ne.	4	10	0.00	0.86
21	78	75	ne.	2	10	0.07	0.00
22	85	73	ne.	1	6	0.40	0.10
23	83.3	75	sw.	3	5	0.01	0.14
24	83	74.5	sw.	3	9	0.10	0.00
25	80	74	sw.	4	10	0.01	0.39
26	82	76	sw.	6	9	2.84	0.24
27	80	75	sw.	6	8	4.21	0.99
28	80	75	sw.	6	10	1.70	0.71
29	81.2	75	sw.	3	10	0.80	0.09
30	88.1	74.5	sw.	1	7	0.00	0.00
31	84	75.5	ne.	2	8	1.02*	0.00
Sums	84.3	75.4				19.86	6.45
Means							
Departures						+2.90	

* An additional 0.53 inch that fell later is to be carried over to November. In addition to his record for Rivas, Mr. Earl Flint kindly also sends the rainfall record for Sapoa, which is printed above. The fall at Sapoa was unusually light; that at Rivas, as used by Mr. Flint (30.39 inches, including the 0.53 inch that fell late on the 31st) was 3.43 inches above normal.

METEOROLOGY OF PANAMA.

By Gen. HENRY L. ABBOT (dated Paris, November 11, 1899).

The following additional data are in continuation of my previous contributions to the climatology of Panama and Colon. (See MONTHLY WEATHER REVIEW, May, p. 198, and July, p. 302).

MONTHLY RAINFALL FOR 1899.

The new station, Alhajuela, is on the River Panama, about 18 miles above Gamboa. The height of the instruments is about 50 meters above sea level. The locations of Bohio and Gamboa were given in my previous communication. The following figures for rainfall bring the records up to date:

Stations.	July, 1899.		August, 1899.		September, 1899.	
	Mm.	Inch.	Mm.	Inch.	Mm.	Inch.
Bohio	451	17.76	350	12.99	226	8.90
Gamboa	240	9.45	273	10.94	342	13.46
Alhajuela	297	11.69	259	10.20	205	8.07

At Alhajuela, during the last 19 days of June, 34 mm., or 1.34 inches, fell.

HOURLY TEMPERATURES IN 1899.

The records made by the self-registering thermometer and barometer at Alhajuela have been read off and the means taken by myself, with the results given in the following table:

1899.	Temperatures.						Barometric pressures.					
	July.		August.		September.		July.		August.		September.	
	° C.	° F.	° C.	° F.	° C.	° F.	Mm.	Ins.	Mm.	Ins.	Mm.	Ins.
1 a. m.	25.5	77.9	24.8	76.6	24.7	76.5	760.0	29.92	759.4	29.90	759.9	29.93
2 a. m.	25.3	77.5	24.7	76.5	24.5	76.1	759.7	29.91	759.0	29.88	759.5	29.90
3 a. m.	25.2	77.4	24.5	76.1	24.4	75.9	759.5	29.90	758.8	29.88	759.4	29.90
4 a. m.	25.0	77.0	24.4	75.9	24.2	75.6	759.4	29.90	758.9	29.88	759.6	29.91
5 a. m.	24.9	76.8	24.4	75.9	24.1	75.4	759.6	29.91	759.3	29.89	759.8	29.91
6 a. m.	24.7	76.5	24.3	75.7	24.2	75.6	759.8	29.91	759.5	29.90	760.2	29.93
7 a. m.	24.6	76.3	25.4	77.7	25.7	78.3	760.1	29.93	759.8	29.91	760.6	29.94
8 a. m.	25.1	77.2	26.6	80.0	27.4	81.3	760.3	29.93	760.2	29.93	760.9	29.96
9 a. m.	25.7	78.3	28.4	83.1	29.1	84.4	760.5	29.94	760.2	29.93	760.9	29.96
10 a. m.	26.8	80.2	29.1	84.4	30.1	86.2	760.5	29.94	760.1	29.93	760.6	29.94
11 a. m.	27.5	81.5	29.8	85.6	31.0	87.8	760.3	29.93	759.8	29.91	760.2	29.93
Noon	28.2	82.8	29.9	85.8	31.2	88.2	760.0	29.92	759.4	29.90	760.7	29.91
1 p. m.	28.5	83.3	29.5	85.1	30.5	86.9	759.7	29.91	759.0	29.88	759.2	29.89
2 p. m.	28.3	82.9	29.3	84.7	29.9	85.8	759.2	29.89	758.6	29.87	759.9	29.88
3 p. m.	28.5	83.3	29.2	84.6	29.3	84.7	759.9	29.88	758.3	29.86	758.8	29.88
4 p. m.	28.2	82.8	28.8	83.8	28.8	83.8	759.9	29.88	758.2	29.85	758.8	29.88
5 p. m.	27.7	81.9	28.1	82.6	28.2	82.8	759.9	29.88	758.4	29.86	759.0	29.88
6 p. m.	27.1	80.8	27.3	81.1	27.1	80.8	759.3	29.89	758.7	29.87	759.4	29.90
7 p. m.	26.7	80.1	26.7	80.1	26.4	79.5	759.7	29.91	759.1	29.89	759.6	29.91
8 p. m.	26.4	79.5	26.3	79.3	25.9	78.6	760.2	29.93	759.5	29.90	760.3	29.93
9 p. m.	26.3	79.3	25.6	78.1	25.6	78.1	759.5	29.94	759.9	29.93	760.6	29.94
10 p. m.	26.3	79.3	25.3	77.7	25.3	77.5	760.7	29.95	760.1	29.93	760.6	29.94
11 p. m.	26.1	79.0	25.2	77.4	25.0	77.0	760.6	29.94	759.9	29.92	760.5	29.94
Midnight	25.8	78.4	25.0	77.0	24.8	76.7	760.4	29.94	759.7	29.91	760.2	29.93
Means	26.4	79.5	26.8	80.2	27.0	80.6	760.0	29.92	759.3	29.89	759.9	29.92
Maximums	31.0	87.8	34.5	94.1	35.9	96.6	762.2	30.01	761.5	29.98	762.8	30.03
Minimums	22.0	71.6	21.9	71.4	22.0	71.6	756.7	29.79	756.5	29.78	757.0	29.80

The records for these three months are complete, except that during July six days of temperature and three days of pressure records are missing. Nothing is said as to the nature of the self registers, but they are presumably of the Richard pattern and checked by occasional observations of the standard instruments. The observations and records have been made or collected by the officers of the new Panama Canal Company.

TEMPERATURES AT DULUTH, MINN.

By H. W. RICHARDSON, Local Forecast Official (dated October 28, 1899).

Temperature records, Duluth, Minn.

Month.	(1)	Maximum.		Minimum.		(2)	(3)	(4)	Consecutive days.							
	Mean temperature.	Temperature	Day.	Year.	Temperature	Day.	Year.	Times	Above.	Times	Below.	30 falls to 0°	(5)	(6)		
													Maxi- mum.	Mini- mum.	Maxi- mum.	Mini- mum.
°	°	°	°	°	°	°	°	°	°	°	°	°	°	°		
January.....	10.5	51	(28 1877) (14 1894)	-41	2	1885	3	50	15	0	2	0	0	8		
February.....	14.4	58	28 1895	-26	9	1899	3	55	11	0	1	0	0	6		
March.....	23.6	64	23 1899	-26	19	1875	3	60	5	0	1	0	0	3		
April.....	38.1	81	9 1891	+2	1	1881	4	75	16	32	0	1	0	0		
May.....	48.4	88	9 1896	23	8	1888	8	85	2	32	0	1	0	0		
June.....	57.7	92	(28 1883) (19 1893)	35	8	1885) (6 1897)	5	90	2	40	0	2	0	0		
July.....	66.0	99	1 1888	45	1	1885	31	90	3	50	0	3	0	0		
August.....	64.8	95	25 1888	40	31	1886	11	90	2	50	0	3	0	0		
September....	56.5	94	1 1894	29	29	1899	3	90	1	32	0	1	0	0		
October.....	44.8	80	7 1886	+8	51	(25 1887)	9	75	7	32	0	1	0	0		
November.....	28.8	65	(7 1874) (1 1897)	-29	29	1875	6	60	2	0	1	0	2	0		
December.....	17.6	54	12 1891	-34	25	1879	4	50	8	0	1	0	5	0		
Annual.....	39.3	99	* 1883	-41	+	1885	6	12	24				

* July 1. † January 2.

† The maximum temperature of 80° or more occurred twice in 26 years in April and June.

(1) The first column relates to the 29 years, November, 1870, to October, 1899, inclusive, the rest of the table relates to the 26 years, November, 1873 to October, 1899.

(2) The total number of times the temperature equaled or exceeded 50° or other specified degrees.

(3) The average number of times the temperature equaled or fell below 0° or other specified degrees.

(4) Average number of times that the temperatures fell 20° or more in twenty-four hours, and reached zero or lower.

(5) The average of the greatest number of consecutive days whose maximum temperature was 80° or above.

(6) The average of the greatest number of consecutive days whose minimum temperature was zero or below.

The following temperature data for Duluth were prepared for publication in a local paper and, at the request of the Editor of the REVIEW, have been expanded slightly, as shown in the preceding table. A study of the figures here given will show that the climate at the head of Lake Superior is invig-